COMPUTER ABSTRACTS

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GENERAL

1 **Applying for jobs in the electronic computer field.** R. Ward, *Automn. & Auto. Equipment News,* **6,** Nov. 1960, 135-136. Some general advice to applicants for jobs in the computer field.

2 **Automatic graders for programming classes.** J. Hollingsworth, *Commun. ACM,* **3,** Oct. 1960, 528-529. Account of the use of grader programs for checking students' programs at the Rensselaer Polytechnic Institute, Troy, New York.

3 **Conference report on the use of computers in engineering classroom instruction.** *Commun. ACM,* **3,** Oct. 1960, 522-527. Report of a conference sponsored by the Ford Foundation Computer Project, held at the University of Michigan, 29-30 April 1960. Transcriptions of key comments and summaries of discussions on the following topics are given: how, when and where are programming and student use of computers to be placed in the undergraduate and graduate curriculum; actual use of computers in the classroom; and computer facilities and mechanisms for use by students and faculty.

4 **Corrigenda**. *Commun. ACM,* **3,** Oct. 1960, 540-541. The character set given in "Some thoughts on reconciling various character set proposals", E. A. Voorhees, *ibid,* **3,** July 1960, 408-409 (*C.A.*, **4,** Sept. 1960, Ref. 1628), is reproduced with certain corrections.

5 **A general model for relating human factors to ADP system performance.** J. B. Teeple, *1960 IRE Wescon Convn. Record,* Part 4, 173-178. In order to evaluate automatic data processing systems, it is important to define equipment performance; it is then possible to indicate certain relationships between man's performance and the performance of the system as a whole. This paper develops such a general model, using time to process information as a criterion of ADP system performance. The points in the system where the human component may affect system performance are identified and mathematical formulas are presented to indicate how criterion values may change as a result of variations in human performance. The implications of this model for the analysis and evaluation of ADP systems are indicated.

6 **How to run the computer department.** P. M. Bridgeman, *Auto. Data Processing,* **2,** Nov. 1960, 14-17. The organisation of computer operation so as to use the computer most efficiently is outlined. This article is one of a series on automatic data processing planning and practice—for previous articles, see *C.A.*, **4,** Refs. 292, 293, 294, 766, 1110, 1385, 1625, 1891 and 2075.

7 **Organization and people.** J. Caruso, *Data Processing* (Detroit), **2,** Nov. 1960, 17-20. This article discusses the selection, training and duties of three personnel in an electronic data processing department, namely the systems analyst, the programmer and the director of the department.

8 **A protest.** F. Gruenberger, *Commun. ACM,* **3,** Oct. 1960, A10,529. Letter commenting on "The future of automatic digital computers", A. D. Booth, *ibid,* **3,** June 1960, 339-341, 360 (*C.A.*, **4,** August 1960, Ref. 1382—for abstract see *C.A.*, **4,** June 1960, Ref. 758), and stating that it is "riddled with inaccuracies". Some examples are given of the alleged "flamboyant errors".

9 **Reducing human error in ADP systems.** J. B. Teeple, *Datamation,* **6,** Nov./Dec. 1960, 91-94. This article presents eight principles, together with experimental findings in their support, which will reduce human error in automatic data processing systems. These principles are: Provide a sufficient number of operators so that extreme fatigue will not result; Adjust length of on/off time so that fatigue resulting from continuous work is minimised; Design the operating environment with adequate ventilation and temperature control; Provide adequate workspace and seating so excess fatigue does not result from discomfort; Provide for control and display locations, separations and labelling to facilitate correct input and output information; Insure good reception for voice communication; Provide sufficient lighting to insure readability of visual displays; and Assure design of display materials to facilitate accuracy of interpretation. 15 refs.

10 **Report on a Conference of University Computing Center Directors June 2-4, 1960.** *Commun. ACM,* **3,** Oct. 1960, 519-521. General report of a conference held at Chicago, 2-4 June 1960. The general conclusions of the conference as to the basic policy of University computing centres are stated, the need to train more experts in the field of computing science being emphasized. Recommendations as to financing, service to the university, and instruction and research are outlined.

11 **Small computers in a large computer environment.** F. Cole, *Datamation,* **6,** Nov./Dec. 1960, 87-88. This article explains why the Missiles and Space Systems Engineering Department of the Douglas Aircraft Company find it useful to have small computers (four G-15D computers) for direct access programming and operating by the engineer as well as large computers such as the IBM 709.

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12 **Theory of switching.** H. Aiken, Harvard University, *PB 147348,* 1956, 193 p. Contents: The synthesis of a special class of switching functions; Silicon carbide crystal switches; The decomposition of switching functions; A theorem concerning two-terminal switching networks; On the functional separability of Boolean functions; Recording on thin magnetic films with a single wire polepiece, preliminary report; A mathematical model for single wire recording; Circuit synthesis for network switching functions. 64 refs.

13 **Theory of switching.** H. Aiken, Harvard University, *PB 147351,* 15 Dec. 1958, 173 p. Contents: The use of adding transformations in the synthesis of switching functions; Notes on the subfunctions of switching functions; Identification and optimal realization of a class of switching functions; Transportation problems with joint capacity constraints; Refined methods of solving the traveling-salesman problem; Magnetic core parallel adder. 19 refs.

14 **Theory of switching.** H. Aiken, Harvard University, *PB 147349,* 1 June 1959, 138 p. Contents: Modular functions; Transportation problems with equality constraints; The description of finite sequential processes; A Harvard Univac method for the selection of the prime implicants of a switching function; The derivation of minimal forms for incompletely defined switching functions. 14 refs.

15 **What is code?** G. W. Patterson, W. I. Landauer and E. J. Parker, University of Pennsylvania, *PB 149396,* 31 July 1959, 43 p. This study involves the definition of the word 'code' and the word's relation to current meanings. It also defines syntactical subbases and syntactical bases, and it explains the formalised mathematical model of rules for forming expressions from these characters, known as a concatenation algebra. A code is a non-singular transformation from a syntactical base into another syntactical base and one that is effectively calculable. The process of coding is that of finding the expression in the code language and decoding is the inverse action—both of which must be capable of being programmed on a computer. 12 refs. (A paper adapted from this report appeared in *Commun. ACM,* **3,** May 1960, 315-318—*C.A.,* **4,** July 1960, Ref. 1108.)

DESIGN

16 **25-mc clock-rate computer circuits for operation from −20°C to +100°C.** C. R. Cook, *1960 IRE Wescon Convn. Record,* Part 4, 105-115. This paper shows that current mode logic systems can be designed to operate at high temperatures (100°C) using complementary silicon mesa transistors. In the first part of the paper techniques are discussed that can be employed to design current mode circuits utilising the minimum number of components and still operate at the maximum possible speed of given transistors. Complementary and non-complementary circuits are compared; other techniques discussed are the use of a diode when the complement output is not required, diode logic with current mode amplifiers, inhibit techniques and techniques to perform OR without additional transistors. The second part of the paper describes the design of a 20mμsec full adder, a 25 Mc/sec shift register and a clock pulse generator. 3 refs.

17 **Diodeless core logic circuits.** S. B. Yochelson, *1960 IRE Wescon Convn. Record,* Part 4, 82-95. This paper is concerned with a system of logic circuitry, developed at Goodyear Aircraft Corporation, which is based on the use of conventional square-loop ferrite magnetic cores for all operations, semiconductor or other active coupling elements not being required. It differs from other diodeless core logic systems in that there are no inherent limits on speed, logic capabilities or branching (fan out) capabilities other than the characteristics of the cores themselves. The system uses the threshold characteristics of the magnetic cores as the nonlinearity needed to achieve directivity of information flow. In addition to the cores needed as information storage elements, added cores are used in place of the diodes or similar nonlinear devices found in conventional core logic systems. Control of directivity is achieved by biasing certain cores up to their thresholds, resulting in the inhibiting of some cores from switching and the aiding of the switching of others. Arrangements are made so that the voltages induced into each coupling loop by a switching core are always opposed by another switching core. Hence, there is no need to reset some cores slowly. 4 refs.

18 **A dynamic technique for sixteen megacycle clock rate.** T. P. Bothwell, J. L. DeClue, H. H. Hill and J. R. Longland, *1960 IRE Wescon Convn. Record,* Part 4, 116-126. This paper describes a family of 16 Mc/s dynamic logic packages which employ non-return-to-zero information signals. Functional equivalence to pulse-dynamic logic is demonstrated and principles of non-return-to-zero dynamic signal representation operation are reviewed. The basic circuit package, a logic element, is described functionally. Circuit operation and performance is reviewed. Compatible passive and active delay lines are also described. Supporting master and local clock packages are described and clock transmission and timing problems discussed. Problems of signal wiring and transmission are considered and a sample logical structure presented. Packaging and cooling problems are detailed and selected solutions are presented. 2 refs.

19 **The polymorphic principal in data processing.** H. A. Keit, *1960 IRE Wescon Convn. Record,* Part 4, 24-28. This paper discusses the "polymorphic" concept of data processing a special organisation of computer elements in which control, arithmetic and other functions are allocated to separate, self-contained modules instead of being centralised in one element and modules are connected to each other through a passive switching network operating at electronic speed. Three main advantages of this system are explained: adaptability—because different modules can simultaneously work on separate problems or separate aspects of one problem; expandability—because users can add to the system in small increments according to need; and dependability—because no single unit failure can disable the entire system. The functions and capacities of individual modules are outlined.

20 **Zur Störreduktion in Ferritkern-Matrizenspeichern.** (Noise reduction in magnetic core matrix memories.) K. Bandat, *Elektronische Rechenanlagen,* **2,** Nov. 1960, 177-182. (In German.) English abstract: "The functioning of ferrite core matrix memories is hindered by disturbances in the read-out signal. The nature of these disturbances is discussed. A new complementary-type read-out procedure avoids disturbances caused by irreversible flux changes in the ferrite cores." 4 refs.

21 **Methods for obtaining complete digital chains.** B. Lippel and I. J. Epstein, Army Signal Research and Development Lab., Fort Monmouth, New Jersey, *PB 149383,* 30 June 1957, 18 p. Two methods are described and proved for obtaining complete digital chains (chain coded sequences which contain all the possible permutations of p kinds of symbols taken n at a time). A generalised permutation method for complete chains is also given. Possible engineering applications for chain codes are considered. 8 refs.

22 **Matrix readout.** Standard Telephones & Cables Ltd., *B.P. 850845,* 12 Oct. 1960. A magnetic core matrix is provided with specified parallel-serial readout arrangements.

23 **Cryotron circuitry.** Western Electric Co., Inc., *B.P. 851239,* 12 Oct. 1960. A cryotron circuit which operates in the manner of a relay circuit with front contacts, comprises two parallel branches one of which contains only cryotron cores and the other the winding of one of the cryotrons.

24 **Arithmetic unit.** Int. Business Machines Corp., *B.P. 851371,* 19 Oct. 1960. In an arithmetic unit operating in the V.H.F. range pulses from a number generator are selectively passed by gating means to an input of an adder the output of which is connected to its other input by a loop in which a delay is introduced so that the pulses at both inputs are in phase.

25 **Matrix selection circuitry.** Sperry Rand Corp., *B.P. 851455,* 19 Oct. 1960. A magnetic core or other matrix is provided with selection circuitry which employs magnetic cores.

26 **Digital computer circuitry.** Int. Business Machines Corp., *B.P. 851613,* 19 Oct. 1960. A timing control chain for a digital computer, comprises a bistable magnetic core device in each stage, and the output of at least one stage can be selectively coupled to the input of the preceding or succeeding stage.

27 **Digital circuitry for performing division.** G. Dirks, *B.P. 852182,* 26 Oct. 1960. Circuitry for performing division denomination by denomination comprises a specified arrangement of counters and may be used, for example, to produce a check symbol based on prime numbers.

28 **Digital multiplier.** G. Dirks, *B.P. 852184*, 26 Oct. 1960. This patent is concerned with arrangements which include a magnetic drum or disc for effecting multiplication.

29 **Digital multiplier.** Buchungsmachinenwerk Karl-Marx-Stadt Veb, *B.P. 852205*, 26 Oct. 1960. A multiplier which operates by repeated addition is composed of counters, gates and triggers in a specified arrangement.

30 **Binary number comparator.** Western Electric Co., Inc., *B.P. 852388*, 26 Oct. 1960. A binary number comparator, such as may be required to position the beam of a storage tube, indicates both the magnitude and the sign of the difference between two binary numbers and employs a comparison circuit for each digit position and certain carry arrangements.

31 **Digital multiplier.** Buchungsmachinenwerk Karl-Marx-Stadt Veb, *B.P. 852835*, 2 Nov. 1960. An electronic multiplier for the multiplication of single digit factors by repeated addition, is designed to operate in a manner which shortens the multiplication cycle.

32 **Digital computer control unit.** Decca Record Co., Ltd., *B.P. 852873*, 2 Nov. 1960. A sequential control unit for digital computers, comprises bistable devices with each of which a gate is associated and two gate-controlling circuits, one circuit for each series of alternate gates.

33 **Data storage matrix circuitry.** Int. Computers & Tabulators Ltd., *B.P. 853614*, 9 Nov. 1960. A magnetic core or other matrix is provided with specified transfer circuit arrangements for reinserting readout data.

See also :—
Learning and Pattern Recognition, Ref. 35.

LEARNING AND PATTERN RECOGNITION

34 **An adaptive character reader.** P. Baran and G. Estrin, *1960 IRE Wescon Convn. Record*, Part 4, 29-41. A pattern recognition system utilising information derived from a machine learning operation is proposed. The proposed machine can deal with a variety of type faces; instead of manually creating an entirely new recognition algorithm each time a new type face is encountered, the system described utilises samples of the text to be read to set the parameters of a more generalised algorithm. Samples of a set of characters are first identified by a human operator. From such inputs to the machine, a probability matrix (of ink spots in elementary sub-areas) is computed and used to derive a set of weighted filters or stencils which distinguish each character relative to the set of possible characters. When unknown characters are read, the proposed pattern recognition machine produces estimates of the confidence of the identification. A digital simulation, on an IBM 709, of the proposed technique is described. 12 refs.

35 **Adaptive switching circuits.** B. Widrow and M. E. Hoff, *1960 IRE Wescon Convn. Record*, Part 4, 96-104. This paper presents an approach to the problem of designing logical networks for use where it is not essential for the truth table to be followed precisely and reliably and some errors can be accepted; this approach does not involve an explicit use of the truth table. The design objective is the minimisation of the average number of errors rather than a minimisation of the number of logical elements used. The system design procedure is adaptive and is based upon an iterative search process. Performance feedback is used to achieve automatic system synthesis, i.e. the selection of the "best" system from a restricted but useful class of possibilities. The designer "trains" the system to give the correct responses by "showing" it examples of inputs and respective desired outputs. After introducing the neuron element used in the adaptive switching circuits, an account is given of an adaptive pattern classification machine, called Adaline, constructed to illustrate adaptive behaviour and artificial learning. Following a summary of the statistical theory of adaptation for sampled-data systems, the statistical theory of adaption for the adaptive neuron element is presented. Networks of adaptive neurons and the possibilities of adaptive microelectronic systems are then discussed. Finally, applications of adaptive logical circuit elements in digital computers such as problem-solving machines are considered. 15 refs.

36 **Computer conversation compared with human conversation.** P. J. McGovern, *Computers & Automn.*, **9,** Sept. 1960, 6-7, 9-11. This article is concerned with an investigation of the possibility of programming a digital computer to carry on a conversation in a human manner. A general account is given of the computational procedure and the IBM 704 program employed. A number of statements regarding the weather were given to the machine and replies were also obtained from human beings. A different group of people were then asked to pick out for each statement the computer reply from the human reply. (See in this respect, Ref. 37.) It is concluded that by using a relatively simple application of logical syntactical analysis of English sentences concerning the subject of the weather, it is possible to provide a computer with the capability of creating responses in the form of English sentences which are largely indistinguishable from those expected of human beings. 8 refs.

37 **Can you tell the computer's responses from the people's responses?** P. J. McGovern, *Computers & Automn.*, **9,** Sept. 1960, 12-14, 16. The 25 statements about the weather used in the investigation of computer conversation described in the article abstracted in Ref. 36, are listed. For each statement, the computer response and nine responses by human beings are given but without indicating which is which. A key identifying the computer's responses is given in *ibid*, **9,** Oct. 1960, 26.

38 **Human decision making as related to air surveillance systems.** A. P. Chenzoff, R. L. Crittenden et al., Dunlap and Associates, Inc., *PB 149215*, 10 June 1960, 128 p. This report presents a review of the literature on decision making. The objectives of the survey were to describe some of the decision making information now available in the areas of mathematics, experimental psychology, sociology and systems research and to identify areas for further experimentation on human decision making. 471 refs.

39 **Information retrieval and the design of more intelligent machines.** H. J. Gray, O. Aberth et al., University of Pennsylvania, *PB 159395*, 31 July 1959, 216 p. In order to reduce the requirements on the personnel who use data processing systems, the systems should be designed to have more intelligence. From study of human processes, a multiple list structure for information is proposed and studied. When applied to an information retrieval problem, it is found to be up to 30,000 times faster than conventional techniques. Results of investigations into the design of an optimised system are given. It is shown that the mulitple list structure can perform with greater efficiency all that the Newell-Simon IPL can. Techniques are explored for the retrieval of information having descriptors which are not the same as those under which the item was filed. Results of a study of the nervous system are given leading to specification of a parallel-access information bank which may be more efficient than the multiple list structure. Finally, some results of psychological experiments on human beings are successfully predicted from the theory of the multiple list structure. 15 refs.

40 **Mathematical neurophysiology.** J. D. McKnight, Lockheed Aircraft Corp., *PB 148941*, Oct. 1959. 8 p. The purpose of this report is to abstract the essential mathematical elements of the classical studies made since the mid-thirties by various researchers and to extend and elaborate these elements where possible and expedient.

41 **Character recognition.** Standard Telephones & Cables Ltd., *B.P. 852665*, 26 Oct. 1960. Character recognition is effected according to this patent by moving a spot of light along certain scanning tracks so that each character to be identified intersects a different combination of the tracks.

42 **Character recognition.** Nat. Cash Register Co., *B.P. 854680*, 23 Nov. 1960. A character sensing device produces signals having waveforms representative of the character sensed and these signals are supplied to a delay line which produces distinctive potentials at sampling points along the line; a different combination of such points is connected to a collating network provided for each character.

43 **Character recognition.** Standard Elektrik Lorenz A.-G., *G.P. 1090890*, 13 Oct. 1960. Characters to be identified are scanned with a light spot, all characters being scanned in an identical predetermined number of lines irrespective of their height.

See also :—
Applications: Simulation, Ref. 190.

MATHEMATICS

44 **On the Kantorovich inequality.** A. H. Schopf, *Numerische Mathematik,* **2,** 12 Oct. 1960, 344-346. A proof is given of the Kantorovich inequality. 2 refs.

45 **On the mechanization of the theory of equations.** A Robinson, *Bull. Res. Council Israel,* **9F,** Nov. 1960, 47-70. After referring briefly to recent work on the problem of proving mathematical theorems on a digital computer, it is suggested that it is a natural step in the further development of the subject to select a theory representing a real advance over the elementary parts of the predicate calculus with regard to mathematical significance, but which is not too far removed from the lower predicate calculus with regard to the degree of intricacy inherent in it. The theory selected for the work described in this paper is the elementary theory of equations, i.e. the theory which, in the first instance leads up to the solution of polynomial equations by standard formulae. A semantically complete calculus suitable for the formulation of the elementary theory of equations is constructed. The principal problem of the theory is to find for polynomial equations $g=(x_1y_1,\ldots y_e)=O$ solutions $x=x(y_1,\ldots y_1)$ expressed by means of given functors (operations). The calculus leads to the formulation of a proof strategy for such problems. 7 refs.

46 **Some inequalities involving the euclidean condition of a matrix.** F. L. Bauer and A. S. Householder, *Numerische Mathematik,* **2,** 12 Oct. 1960, 308-311. Four theroems and their corollaries are presented. 6 refs.

47 **Combinatorial problems.** A. W. Tucker, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 454. Brief foreword to a supplementary issue of the *IBM Journal of Research and Development* devoted to combinatorial problems. It is pointed out that "Combinatorial Mathematics . . . has to do with problems of arrangement, operation, and selection within a finite or discrete system—such as the aggregate of all possible states of a digital computer." The wide range of applications for combinatorial methods is briefly indicated. 4 refs. The papers introduced by this foreword are abstracted below in Refs. 48 to 59.

48 **Traces, term ranks, widths and heights.** D. R. Fulkerson and H. J. Ryser, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 455-459. The notions of widths and heights of $(0,1)-$matrices are discussed in the general setting of known results concerning traces and term ranks. Proofs are omitted. 21 refs.

49 **Automorphisms of Steiner triple systems.** M. Hall, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 460-472. This paper treats the following problem in combinatorial analysis: Find an incomplete balanced block design D with parameters $b, v, r, k,$ and $\lambda=1$, possessing an automorphism group G which is doubly transitive on the elements of D and such that the subgroup H of G fixing all the elements of a block is sharply transitive on the remaining elements. Also find transitive extensions of such groups G. If the block design is a finite projective plane, the plane is necessarily Desarguesian. Thus, these properties of the automorphism group may be considered as a "Desarguesian" property of the designs. The case in which D is a Steiner triple system is considered. The main result is that a "Desarguesian" Steiner triple system is either a projective geometry over $GF(2)$ or an affine geometry over $GF(3)$. 5 refs.

50 **The enumeration of trees by height and diameter.** J. Riordan, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 473-478. The enumeration of trees begun elsewhere is simplified and elaborated in the interest of obtaining reliable numerical results. Height is a characteristic of a rooted tree, the length in lines of the longest path from the root, while the diameter of a (free) tree is the length of the longest path joining two endpoints. The most general enumerations given are for the case where a fixed number of the points of the trees are labelled with distinct labels, which puts in one setting the classical contrast of all points alike and all points unlike. The numerical tables given extend to trees with 20 points, all alike, and to trees with 10 points, all unlike. 4 refs.

51 **Maximal paths on rectangular boards.** R. E. Miller and J. L. Selfridge, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 479-486. A combinatorial approach is made to the problem of obtaining a path on a rectangular board of m by n squares with both terminals at the edges of the board. A square is said to be covered when the path enters one edge and leaves an adjacent edge. All other squares are said to be missed. Maximal paths are found, i.e. those which cover a maximum number of squares. For $m=n$, $m-2$ squares are missed when m is even, and $m-1$ squares are missed when m is odd. For $m<n$, $m-2$ squares are missed if m is even, and n-2 squares are missed if m is odd. The method of proof for m and n even is quite different from that for m or n odd. Certain properties of terminal positions, path lengths, types of missed square and unique paths are also investigated.

52 **On the exceptional case in a characterization of the arcs of a complete graph.** A. J. Hoffman, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 487-496. It is known that a certain simple set of properties characterize the relationship of adjacency of the $n(n-1)/2$ arcs of the complete graph of order n, when $n \neq 8$, and that these properties are not a sufficient characterization when $n=8$. The present paper describes a method for enumerating all counterexamples when $n=8$. 7 refs.

53 **On Moore graphs with diameters 2 and 3.** A. J. Hoffman and R. R. Singleton, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 497-504. This paper treats the existence of connected, undirected graphs homogeneous of degree d and of diameter k, having a number of nodes which is maximal according to a certain definition. For $k=2$ unique graphs exist for $d=2$, 3, 7 and possibly for $d=57$ (which is undecided), but for no other degree. For $k=3$ a graph exists only for $d=2$. The proof exploits the characteristic roots and vectors of the adjacency matrix (and its principal submatrices) of the graph.

54 **Inductive proof of the simplex method.** G. B. Dantzig, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 505-506. Instead of the customary proof of the existence of an optimal basis in the simplex method based on perturbation of the constant terms, this paper gives a new proof based on induction. It is shown that there exists a finite chain of feasible basis changes, which results in either an optimal feasible solution or in an infinite class of feasible solutions, such that the objective form tends to minus infinity. 2 refs.

55 **Solving a matrix game by linear programming.** A. W. Tucker, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 507-517. This paper presents a new characterisation, via linear programming, of extreme optimal strategies of a matrix game and a simple direct procedure for computing them. 10 refs.

56 **Some combinatorial lemmas in topology.** H. W. Kuhn, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 518-524. It is known that a combinatorial result, called the Sperner Lemma, provides an elegant proof of the Brouwer Fixed Point Theorem. Although the proof is elementary, its complete formal exposition depends upon the somewhat complicated operation of subdividing a simplex. The central result of this paper is a combinatorial proposition, analogous to the Sperner Lemma, and applying to the n-cube, for which subdivision is a trivial operation. This Cubical Sperner Lemma follows immediately from the Brouwer Fixed Point Theorem and thus opens the possibility of other applications of topology to combinatorial problems. 5 refs.

57 **Minimal complete relay decoding networks.** E. F. Moore, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 525-531. It has always been assumed that the $2(2^n-1)$ contacts used in the standard relay-contact-tree network (having n relays) is the smallest possible number of contacts with which such a network could be made. This paper proves that this is true, provided no sneak paths are allowed. This is in contrast to the result obtained by Lupanov, who showed that when n is five or more it is possible to save contacts below the usual number by permitting sneak paths. This paper proves further theorems about any network which satisfies the same specifications as an n-relay tree without sneak circuits, and which is built with the minimal number of contacts. 14 refs.

58 **A bound for error-correcting codes.** J. H. Griesmer, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 532-542. This paper gives two new bounds for the code word length n which is required to obtain a binary group code of order 2^k with mutual distance d between code words. These bounds are compared with previously known bounds, and are shown to improve upon them for certain ranges of k and d. Values of k and d are given for which one of these bounds can actually be achieved; in such cases, the structure of the resulting codes is shown to satisfy a certain condition. 6 refs.

59 **Minimization over Boolean trees.** J. P. Roth, *IBM J. Res. & Dev.,* **4,** Nov. 1960, 543-558. An algorithm is provided for what is termed "the general problem of logical design of circuits with one output and no feedback. Given a set of logical building blocks, each with a positive cost, each with one output, and given a Boolean function f the problem is to prescribe a Boolean tree constructed from the available set of building blocks which realises f and which has a minimum cost. Actually a more general problem involving *don't care* conditions is treated. A special case of this problem is the classical logical problem of finding a functional expression for a given logical function which uses a minimum number of conjunctions, disjunctions and negations. Programmed on an IBM 704, the algorithm is believed to be efficient on problems with eight or less variables. 16 refs.

60 **Rational approximation of arbitary real functions with specified weights.** T.-N. Tang, University of Illinois, *PB 148766*, 1 May 1960, 99 p. The problem of obtaining the Tchebysheff approximation of a real continuous function in a closed interval by a polynomial or a rational function under a specified weighting function is treated. Solutions of such problems are obtained by numerical methods involving iterative procedures which may be carried out by computers. The effect of shifting a zero or several zeros of an error function on the weighted error function itself is obtained by multiplying the amount of shift by the sensitivity, defined as the partial derivative of the weighted error function with respect to the zero shifted. The successive equalisation of the weighted error function at the points of extrema gives an iterative procedure with assured convergence of the process. 25 refs.

61 **The use of Chebyshev matrix polynomials in the iterative solution of linear equations compared to the method of successive overrelaxation.** G. H. Golub, University of Illinois, *PB 148792*, 16 March 1959, 137 p. Contents: On averaging processes; A modification of the averaging methods; The numerical behaviour of the generated sequences; A numerical example. 9 refs.

TECHNIQUES

62 **Algorithms.** *Commun. ACM*, **3**, Oct. 1960, 540. Details in ALGOL 60 of the following (with ACM serial number) :

19. **Binomial coefficients.** R. R. Kenyon. Computes binomial coefficients $C_m^n = n!/m!(n-m)!$ by the recursion formula $C_i^n + 1 = (n-1)C_i^n/(i+1)$ starting from $C_o^n = 1$.
20. **Real exponential integral.** S. Peavy. $-E_i(-x) = \int_x^\infty (e^{-u}/u)\,du$ is computed for $x > 0$ by approximation formulas.

There is also a **Remark on Algorithm 16 Crout with pivoting** (See *C.A.*, **4**, Nov. 1960, Ref. 2119), in which the author (G. E. Forsythe) asks "How should one write an inner product procedure in ALGOL?"

63 **Comment on a previous paper.** J. Lieblein, *Commun. ACM*, **3**, Oct. 1960, 536. Brief note referring to "Decoding combinations of the first n integers taken k at a time", R. M. Brown, *ibid*, **3**, April 1960, 235-236 (*C.A.*, **4**, July 1960, Ref. 1187) and giving some additional information, together with an erratum to the author's paper, "A general analysis of variance scheme applicable to a computer with a very large memory", *J. Assn. Computing Machinery*, **6**, Oct. 1959, 469-475 (*C.B.*, **3**, Oct. 1959, Ref. 2364).

64 **Determining transfer-functions with analog computers.** J. H. Milsum, *I.S.A. Jol.*, **7**, April 1960, 54-57. Describes how an analogue computer can be used to readily determine to 1% accuracy up to four unknown constants of a transfer function. The analogue computer simulated system response is displaced on a large oscilloscope, and the parameters of the simulated system adjusted until the oscilloscope trace matches a mask outline of the real system response. An aircraft motion problem is used as an example. 4 refs.

65 **Error analysis of floating-point computation.** J. H. Wilkinson, *Numerische Mathematik*, **2**, 12 Oct. 1960, 319-340. The bounds are derived for the rounding errors made in the fundamental floating-point arithmetic operations and the results, which are true for computations on ACE or DEUCE, are then applied in the analysis of a number of computing techniques for the calculation of the eigenvalues of matrices. In each case the computed solution is expressed as the exact solution of a perturbed version of the original matrix and bounds are found for the perturbations. After considering the evaluation of determinants of triple-diagonal matrices, error bounds are established for the computed eigenvalues of a symmetric triple-diagonal matrix. The error analysis is then applied to the calculation of the eigenvalues of Hessenberg matrices and finally to the eigenvalues of an ill-conditioned matrix. 12 refs.

66 **Evaluating numbers expressed as strings of English words.** C. J. Swift, *Commun. ACM*, **3**, Oct. 1960, 541. Brief note with flow chart of process for evaluating integer numbers expressed by a series of words such as "one hundred thirty three million two hundred four".

67 **Function generation with a DDA.** W. B. Silber, *Instr. & Control Systems*, **33**, Nov. 1960, 1895-1899. A brief general account of a digital differential analyser and its patchboard programming is given with reference to the Packard Bell Computer Corporation's Trice. The generation of the following functions is then outlined: e^x, sine and cosine, reciprocal, power of a variable, and square root. Finally, the solution of a problem involving two second order differential equations is described.

68 **More techniques for counting ones.** C. T. Casale; C. R. Burgess, *Commun. ACM*, **3**, Oct. 1960, A9. Two letters referring to "A technique for counting ones on a binary computer", P. Wegener, *ibid*, **3**, May 1960, 322 (*C.A.*, **4**, July 1960, Ref. 1195). Casale describes a method for obtaining the number of ones in a binary computer word which employs one or more look-up tables. Burgess describes a method for computers in the IBM 709-7090 series which have available the "convert" instructions; this method is similar to that described in "Counting ones on the IBM 7090", S. S. Kutler, *ibid*, **3**, August 1960, 474 (*C.A.*, **4**, Oct. 1960, Ref. 1934). Another method was described in "A variant technique for counting ones", H. Frieden, *ibid*, **3**, August 1960, 474 (*C.A.*, **4**, Oct. 1960, Ref. 1940). See also Ref. 69.

69 **Comments on a technique for counting ones.** P. M. Sherman, *Commun. ACM*, **3**, Oct. 1960, 538. Note referring to "A technique for counting ones on a binary computer", P. Wegener, *ibid*, **3**, May 1960, 322 (*C.A.*, **4**, July 1960, Ref. 1195), and describing a technique in which checking is by bytes instead of by bits. See also Ref. 68.

70 **Some thoughts on parallel processing.** L. D. Yarborough, *Commun. ACM*, **3**, Oct. 1960, 539. Tentative proposal for a hardware scheme which would help to avoid mutual code mutilation in the application of multi-program technique.

71 **Zur Verfahrenstechnik für die Lösung von Schwingsungsproblemen mittels eines elektronischen Analogrechners.** (Details of a method of solution for oscillation problems with the aid of an electronic analogue computer). K. Kuntze, *Ann. Assn. Int. Calcul Analogique*, **2**, Oct. 1960, 170-180. (In German.) The repetition cycle of a repetitive analogue computer can be used to determine the period of an oscillation with the aid of observation by a stroboscope. This procedure also permits the simultaneous observation of several oscillations of the same frequency and thus of their phase differences. This method is explained by means of several examples of free oscillations. The asymptotic curve of a relaxation oscillation is determined as a function of the parameters of its differential equation. A procedure is described for obtaining the resonance curve for forced oscillations.

72 **Design and operation of digital calculating machinery.** H. Aiken, Harvard University, *PB 150300*, 1955, 157 p. This report contains the results of computations completed on the Mark I and Mark IV Calculators. The coordinate determination of ground points on aerial photographs is discussed. A mathematical description of a nonlinear eigenvalue problem is presented. The solution of nineteen linear second order differential equations with two point boundary conditions is reported. 2 refs.

73 **Programs for logical data processing.** V. Kudielka, H. Zemanek et al., Vienna, Austria, *PB 149452*, 29 Feb. 1960, 198 p. Contents: Conventional logical algebra—The function in the logical algebra, Rules for logical computing, Switching networks and logical algebra, Minimization; Sequential logical algebra—Time sequences, Sequential functions, Sequential networks, Application of information theory; Operations on logical functions—The representation of logical variables and functions, Sequential formula translation, Communication with physical objects; Automatic minimization—Different procedures, The minimization procedure by McCluskey, An automatic minimization procedure, Commentaries on the minimization program, Three examples. 35 refs.

See also :—
Mathematics, Ref. 60.

ACCESSORIES

74 **Computer tapes and their care.** G. Cole, *Data Processing* (Detroit), **2**, Nov. 1960, 11-16. This article discusses some precautions against fire, humidity, demagnetisation, dust and shock which are necessary for the safe preservation of magnetic tapes.

75 **Digital data processing system for telemeter-to-computer linkages.** E. H. Claggett, *Auto. Control*, **13**, Nov. 1960, 39-43. This article describes operations performed by *DIDAP* (Digital Data Processor) developed by Radiation Inc., for the Applied Physics Laboratory, John Hopkins University. It is a general purpose data reduction and processing system which accepts and prepares for computer input various types of telemetered and other data. DIDAP saves computer time by performing functions normally allotted to the computer, such as accurate time editing, channel stripping and data formating. Immediate applications are the reduction of telemetry and systems data from the Polaris, Terrier, Tartar and Talos missile programmes.

76 **Encoding techniques for visual displays in computer-aided systems.** K. M. Newman, *1960 IRE Wescon Convn. Record*, Part 4, 66-79. This paper discusses three experimental approaches, under study at the U.S. Navy Electronics Laboratory, to the problem of symbolic encoding for visual displays associated with large computer-aided data handling and processing systems, more particularly those concerned with tactical information. The first study was concerned with the readability of six different symbologies—three geometric, alphabetic, alphanumeric and a combination of geometric and alphanumeric. There was some indication of a faster response time with geometric symbols. The second approach, still under investigation, has as its objective a comparison of the effectiveness—in terms of speed and accuracy—of symbol-only encoding with a non-redundant symbol-plus-other-dimensions code, specifically 2 brightness levels, 3 flashing rates and 3 colours. The theory, criteria and instrumentation are discussed. A third technique, due for investigation, concerns itself with the conveying of tactical messages by using a spatial code within a given frame of reference as compared to presenting these tactical messages in an abbreviated alphabetic code, and it is presented and discussed with reference to method, instrumentation, design and procedure. 33 refs.

77 **A multi-addressable random access file system.** E. A. Coil, *1960 IRE Wescon Convn. Record*, Part 4, 42-47. This paper describes a file system capable of retrieving data on the basis of content alone. The system, called Librafile, was developed by the Librascope Division of General Precision Inc., for an air traffic control data processor. Data are recorded on a magnetic drum in randomly-distributed locations, the availability of which are automatically recognised by the file system itself. The Librafile record length is variable in blocks of eight words of eight alphanumeric characters each. The first 12 characters of each block are designated as key and are recorded in a separate key band on the drum. The remaining 52 characters are assigned a slot in one of eight data bands. A drum can store 1,000 such records. The term "multi-addressable" stems from the fact that several different criteria may be employed either individually or in combination to retrieve a desired piece of information from the file. This is done by comparing, during a single drum revolution, each and every one of the 1,000 recorded keys with the contents of a 12-character key register. By using in this register a special "mask" character which "compares" with anything, irrelevant portions of the key can be ignored during any file search.

78 **Pulse-duration-modulated transmission.** *Control*, **3**, Dec. 1960, 123. Brief account of a data acquisition system introduced by the Electro-Logic Corporation of America, which converts analogue signals into pulse-duration-modulated signals before transmission to central data processing equipment.

79 **Undetected errors in 5-unit code transmission and their elimination.** J. F. Holmes, *Computers & Automn.*, **9**, Nov. 1960, 10-13. This article is concerned with the problem of undetected errors arising with the five unit Baudot code. In the standard "A" code assignment, almost all errors are the result of the loss or gain of a single pulse. It is shown that the solution to the undetected error problem is a reassignment of coding to place all numeric characters into the 10 triples. This prevents the change of a numeric character to another numeric character through the loss or gain of a single pulse. The proposed reassigned coding (called the "L"—for "logical"—code) is essentially a data transmission requirement. 3 refs.

80 **Data transmission in the presence of interference.** R. M. Showers, R. S. Berkowitz et al., University of Pennsylvania, *PB 149393*, 31 July 1959, 135 p. This report concerns studies involving the effects of interference in producing baud errors in a digital data transmission system and the relative efficiency of various error detecting schemes in reducing the number of undetected errors in a transmitted message. The performance of AM and PM systems using standard teletype transmission in the presence of noise recorded from an actual transmission circuit has been investigated. A baud error probability considerably less than one error in 10^5 can be expected with such circuits. From theoretical calculations of the performance of AM, FM and PM systems in the presence of this type of interference it is concluded that the binary PM system is about 3 db better than AM or FM transmission. Of the five detection codes studied in the presence of random, grouped and periodic errors, the transverse-longitudinal parity check proved to be quite superior to the others. 4 refs.

81 **Subroutines for the NORC CRT Printer.** A. V. Hershey, Naval Weapons Lab., Dahlgren, Virginia, *PB 147814*, 9 March 1960, 45 p. The computing programs in a curve plotting routine, a stereographic routine and a character plotting routine are described. Some experimental tests with these routines are believed to be consistent with the following postulates: between the datum points for a curve there is an optimum spacing which will give a distortion-free plotting of the curve for any compression of the scaling; and the visual interpretation of abstract stereograms is consistent with a mental impression that a central point in every image is located at the same absolute distance. 8 refs.

82 **Transistorized building blocks for data instrumentation.** J. A. Cunningham and R. L. Hill, National Bureau of Standards, *PB 161569*, Sept. 1960, 74 p. The National Bureau of Standards has developed a number of modular transistorised digital circuits that have been used in automatising many data recording and preliminary processing tasks encountered in its scientific operations. These versatile building blocks can be connected together systematically to form digital circuits that accept raw data from experimental equipment and transpose the data into a form suitable for input to a computer. This report describes 5 major packages and 8 special purpose packages. 2 refs.

83 **Magnetic recording.** Ing. C. Olivetti & Cie. S.p.A., *B.P. 851344*, 12 Oct. 1960. In the recording of binary digits on magnetic drum, tape, etc., each positive and negative digital pulse is preceded by a pulse of constant polarity to saturate the magnetic record in a predetermined direction.

84 **Magnetic recording.** Int. Computers & Tabulators Ltd., *B.P. 851520*, 19 Oct. 1960. In a magnetic recording system in which binary digits are represented as single and double reversals of magnetic state in a discrete area, reading means generate a single output signal only in response to the double reversal.

85 **Input transducer for analogue computers.** Soc. d'Electronique et d'Automatisme, *B.P. 851543*, 19 Oct. 1960. A mechanical input signal drives a diamagnetic screen which co-operates with an air gap in a magnetic core system which carries windings.

86 **Magnetic data recording apparatus.** G. Dirks, *B.P. 851752*, 19 Oct. 1960. A track on a magnetic drum, disc or the like has several heads co-operating with it so that by means of specified circuitry data can be transferred from another track to a selected position on that track.

87 **Drive for a magnetic drum store.** Veb Elektronische Rechenmaschinen Wissenschaftlicher Industriebetrieb-Karl-Marx-Stadt, *B.P. 851828*, 19 Oct. 1960. A magnetic drum store is driven through a magnetic dog coupling in which the dogs are permanent magnets.

88 **Data transfer apparatus.** Monroe Calculating Machine Co., *B.P. 851854*, 19 Oct. 1960. This patent is concerned with an electronic distributor for producing uniformly-spaced pulses and which is intended in particular for effecting serial-parallel translation of data between a teleprinter and a data processor.

89 **Character display device.** Gen. Electric Co., Ltd., *B.P. 853079*, 2 Nov. 1960. Characters are displayed by flooding a fluorescent screen with an electron beam and applying suitable potentials to conductive members in the shape of characters to cast the shadow of a selected character on to the screen.

90 **Character display apparatus.** Int. Business Machines Corp., *B.P. 853126*, 2 Nov. 1960. In this patent there is described a cathode ray tube circuit which can be used for character display. Positioning currents for the beam are generated by the switching of constant current sources according to a digital code.

91 **Data storage system.** Sperry Rand Corp., *B.P. 853202*, 2 Nov. 1960. A system is specified for reproducing data pulses recorded, on magnetic tape for example, in different phases representative of different binary digits.

92 **Magnetic recording of data.** G. Dirks, *B.P. 853205*, 2 Nov. 1960. In a magnetic data storage system, arrangements are provided for controlling rotation of a magnetic drum or disc to permit recording of a data item to start at a predetermined point on a track.

93 **Checking system for data transmission.** Int. Business Machines Corp., *B.P. 853551*, 9 Nov. 1960. In a digital data transmission system, means are provided for preventing the transmission of signals representing a message when the message does not contain a predetermind number of words.

94 **Thermoplastic recording system.** Gen. Electric Co., *B.P.* 853841, 9 Nov. 1960. Data is stored by physical deformation of a thermoplastic caused by an electron beam which is focussed by an electron lens element having electrodes which also act for radio frequency heating of the thermoplastic.

95 **Recoding of digital data.** Int. Business Machines Corp., *B.P. 853910,* 9 Nov. 1960. Digital data is recoded by means of apparatus which comprises a matrix of input and output conductors provided at selected intersection points with inductive couplings.

96 **Analogue computer input.** Gulf Research & Development Co., *B.P. 854265,* 16 Nov. 1960. A movable element forming part of an analogue computer is automatically positioned by electrical means according to the magnitude of a physical quantity represented by a perforation in a punched card.

97 **Code converter.** Int. Business Machines Corp., *B.P. 855399,* 30 Nov. 1960. A code converter which is specially designed for use with a magnetic drum and which converts data signals between parallel and series-parallel forms, is provided with terminals in two unequal groups and between which there are direct connections and connections including delay means.

98 **Magnetic card data storage system.** Sperry Rand Corp., *U.S.P. 2940068,* 7 June 1960. This patent is concerned with a data storing system employing magnetic cards on each of which bits are magnetically recorded in spaced parallel tracks. The cards are slidably mounted in a cabinet from which a selected card can be withdrawn and returned to the cabinet by a puller mechanism mounted on a movable carriage arrangement carrying reproducing heads which co-operate with the tracks on the card as it is withdrawn.

99 **Analogue-to-digital converter.** Phillips Petroleum Co., *U.S.P. 2940071,* 7 June 1960. A converter in which an analogue voltage to be converted to a digital representation, is compared with an adjustable voltage derived from voltage dividing networks.

100 **Decimal-to-binary converter.** Gen. Electric Co., *U.S.P. 2940669,* 14 June 1960. A decimal-to-binary converter in which each order of a multi-digit decimal number is applied in turn to converting means producing the binary form of the decimal digit applied to it, and the successive outputs of the converting means are summed in an accumulator.

101 **Analogue-to-digital converter.** Vitro Corp. of America, *U.S.P. 2941196,* 14 June 1960. This patent concerns a converter in which an analogue voltage is sampled, at a rate dependent on the conversion accuracy required, to generate variable width timing pulses having a duration determined by the amplitude of the analogue voltage during the sampling period. These pulses may be employed to control the transmission of constant frequency reference pulses to a counting circuit.

ELEMENTS

102 **Vergleich neuer Speicherelemente für elektronische Rechenmaschinen.** (Comparison of new storage devices for electronic computers). E. Schaefer, *Elektronische Rechenanlagen,* **2,** Nov. 1960, 183-193. (In German.) English abstract: "Starting with a discussion of the requirements to be considered for memory units in digital computer design, the author defines storage characteristics as a basic reference. After comparing former and present data storage techniques, the mutual relation is displayed of those memory elements which have become known within the past five years. For each example the storage principle is indicated and both advantages and drawbacks are discussed. . . ." 157 (mostly English language) refs.

103 **A binary counter and accumulator using transistors and magnetic cores.** H. R. Irons, Naval Ordnance Lab., White Oak, Maryland, *PB 147565,* 23 Oct. 1958, 30 p. Binary devices are described which employ a transistor magnetic core combination as a fundamental building block for digital circuits. These devices are capable of high operating speeds and yet require very little power at low operating speeds. For example, a five stage binary counter has a total power consumption of 40 micro watts at a counting rate of 100 pulses per second. The same counter is capable of operation at rates as high as 2×10^6 pulses per second.

104 **Ferroelectric memory cells.** R. A. Fotland, Horizons Inc., *PB 148816,* April 1960. Techniques have been developed for obtaining 20 micron films of sodium niobate and barium-lead titanate ceramics. Inferences derived from the switching voltage-film thickness curves indicate the sodium niobate crystallites are surrounded by a 10^{-6} cm parelectric skin. Switching voltages as low as 20 volts have been ultilised with switching pulse lengths of 50 mμsec. A 15 Mc/s read-out voltage functions effectively. The second-harmonic phase of an output current provides a non-destructive read-out. Ten by ten matrices have been examined with a static address and found to possess good uniformity. Coincidence switching is effective due to high loop squareness when operating in the second-harmonic output mode. Indications are presented which show the feasibility of large matrix sizes. 4 refs.

105 **Data storage system.** Gen. Electric Co., *B.P. 850985,* 12 Oct. 1960. In a data storage system of greatly increased storage density, an electron or other charged particle beam is focused to a spot diameter below the resolution of light optical devices and preferably below 300 Å, and the physical or chemical state of discrete areas of the storage medium is affected by the primary radiation effects of the beam.

106 **Magnetic core matrix.** Nat. Research Development Corp., *B.P. 851039 & 851040,* 12 Oct. 1960. These two patents are concerned with a magnetic core matrix in which there is provided for each digit a storage core and a switching or driving core.

107 **Digital data storage device.** Nat. Cash Register Co., *B.P. 851697,* 19 Oct. 1960. A luminiferous element for a digital data storage device, comprises a rigid foraminous sheet in which each hole contains a luminophore sealed from the ambient environment.

108 **Constructional method for a magnetic core matrix.** Int. Business Machines Corp., *B.P. 852278,* 26 Oct. 1960. A desired winding pattern through magnetic cores is produced by stacking core-supporting elements, threading a wire through the cores and, after re-aligning the elements to form different columns of cores, again threading the wire.

109 **Shift register.** Soc. d'Electronique et d'Automatisme, *B.P. 852375,* 26 Oct. 1960. In a shift register which has a pair of magnetic cores in each stage, interstage circuits each comprise windings of the two adjacent stages in a closed transfer loop.

110 **Decade counter.** Laboratoires d'Electronique et de Physique Appliquees, *B.P. 852479,* 26 Oct. 1960. A decade counter is formed by four bistable circuits with specified arrangements for converting the count from binary to decimal.

111 **Construction of magnetic core matrices.** Int. Business Machines Corp., *B.P. 852543,* 26 Oct. 1960. A filament is threaded through a row of aligned elements, such as magnetic cores, with the aid of a tube.

112 **Logical element.** Nat. Cash Register Co., *B.P. 852702,* 26 Oct. 1960. An electro-optical switching unit for use in logical circuitry, comprises electroluminescent elements each optically connected to a variable resistance photoconductive cell.

113 **Magnetic core switching circuit.** Soc. d'Electronique et d'Automatisme, *B.P. 852791,* 2 Nov. 1960. A magnetic core switching circuit for performing the EXCLUSIVE OR function and which can be used for controlling a magnetic core matrix, comprises two cores each with three windings connected in a specified manner.

114 **Magnetic core data handling circuitry.** Soc. d'Electronique et d'Automatisme, *B.P. 852794,* 2 Nov. 1960. A magnetic core circuit for handling binary data, which is of the two core per bit type, is designed for improved efficiency and reliability.

115 **Data storage device.** E. H. Nazare, *B.P. 853069,* 2 Nov. 1960. This patent is concerned with a data storage device employing two layers of parallel conductors which are arranged so as to intersect without touching and thereby form spark gaps. Recording is effected by a disruptive discharge which permits passage of current for a given voltage during reading.

116 **Magnetic core matrix.** Int. Business Machines Corp., *B.P. 853125,* 2 Nov. 1960. Each row and column of a magnetic core matrix has a switch element to connect its conductor across a row or column driver, the switch element comprising a transistor arranged for operation between low and high resistance states.

117 **Ferroelectric data storage device.** Gen. Electric Co., Ltd., *B.P. 853193,* 2 Nov. 1960. A data storage device which can be used in a ferroelectric matrix for example, comprises two electrodes between which ferroelectric material and material having a non-linear impedance characteristic are arranged in series.

118 **Pulse generator.** Int. Business Machines Corp., *B.P. 853413,* 9 Nov. 1960. A pulse generator particularly suited to driving a magnetic core matrix, is provided with a negative feedback circuit which is connected from the output of a power stage through an AND circuit to the input of the stage; the feedback circuit comprises an amplifier with bias set by a potentiometer.

119 **Superconductive switching device.** Int. Business Machines Corp., *B.P. 853463,* 9 Nov. 1960. This patent concerns a switching device in which the relative impedances of parallel circuits are changed by changing the inductances of conductors in the circuits by means of adjacent superconductive objects which are switched to resistance states by selectively applied magnetic fields.

120 **Function generator.** Gen. Electric Co., Ltd., *B.P. 853554,* 9 Nov. 1960. The accuracy of a power law function generator is improved by means of circuit arrangements for correcting for variations in the value of α for a non-linear resistor.

121 **Superconductive circuit.** Thompson - Ramo - Wooldridge Corp., *B.P. 853675,* 9 Nov. 1960. A superconductive circuit which is particularly suitable for the storage of digital data, employs two superconductive conductors with different values of critical current and which sustain a persistent circulating current.

122 **Magnetic core.** Sperry Rand Corp., *B.P. 854153,* 16 Nov. 1960. A magnetic core, particularly of the thin film type, is nondestructively sensed with the aid of a second core disposed adjacent to the first core, the axes of remanent magnetisation of the two cores being transverse.

123 **Magnetic core matrix.** Int. Business Machines Corp., *B.P. 854380,* 16 Nov. 1960. A magnetic core matrix for use where storage and readout is always in words of a given size, has column conductors interconnected in a specified manner to simplify selection arrangements.

124 **Half adder.** Int. Business Machines Corp., *B.P. 854447,* 16 Nov. 1960. This patent is concerned with a half adder employing a magnetic core with certain windings.

125 **Magnetic core circuit package.** Int. Business Machines Corp., *B.P. 854714,* 23 Nov. 1960. A magnetic core is retained in a cavity formed in one face of a panel by means of a closure member, and the panel and closure member have conductor-receiving channels registering with corresponding channels in the core.

126 **Magnetic core for data storage.** Philips Electrical Industries Ltd., *B.P. 854831,* 23 Nov. 1960. A magnetic core is made by a method in which a sintered ring formed from a mixture of oxides of iron, manganese and copper is cooled so that, at least in the range from 700°C to room temperature, the cooling takes place in a gaseous atmosphere having a smaller oxygen content than the atmosphere in which sintering takes place.

127 **Bistable circuit.** Minister of National Defence of H.M. Canadian Government, *B.P. 854910,* 23 Nov. 1960. A cross-connected pair of complementary junction transistors are employed in the bistable circuit described in this patent.

128 **Function generator.** Gen. Electric Co., Ltd., *B.P. 855303,* 30 Nov. 1960. A generator of a function which is proportional to the sum of a convergent power series, for example a series expansion of a trigonometrical function, comprises an adding circuit which includes an amplifier with feedback and is supplied with specified currents.

129 **Bistable circuit unit.** Avco Manufacturing Corp., *U.S.P. 2939967,* 7 June 1960. A bistable circuit employing PNP and NPN transistors, is designed as a plug-in unit or building block for logical circuitry.

130 **Gating circuit.** Burroughs Corp., *U.S.P. 2940047,* 7 June 1960. A multi-position gating circuit which can be used with magnetic core matrices, employs two multi-position magnetron beam switching tubes.

131 **Bistable circuit.** Sperry Rand Corp., *U.S.P. 2940066,* 7 June 1960. A bistable circuit in which the need for gates is eliminated by employing two magnetic amplifiers of a modified form providing both complement and direct outputs together with a non-complementing amplifier.

132 **Magnetic core logical circuit.** Gen. Dynamics Corp., *U.S.P. 2940067,* 7 June 1960. A diode-controlled bistable magnetic core circuit which can form the basis of various logical circuits.

133 **Magnetic core counting circuit.** Bell Telephone Labs., Inc., *U.S.P. 2941089,* 14 June 1960. A binary counting circuit comprising a pair of magnetic cores, a winding on one core being connected in parallel with the series-connected winding on the other core and a capacitor.

134 **Magnetic core shift register.** Bell Telephone Labs. Inc., *U.S.P. 2942241,* 21 June 1960. A shift register employing magnetic cores, is designed so that readout of stored data without shifting the data out of the register is possible.

135 **Magnetic core shift register.** Burroughs Corp., *U.S.P. 2943301,* 28 June 1960. A shift register employing magnetic cores is provided with improved conditional transfer circuits.

ANALOGUE

136 **The development of the Princeton University Three-Dimensional Analog Computing Facility, and the development of the Princeton University Lifting Line Calculator.** W. R. Willauer, Princeton University, *PB 147611,* June 1958, 71 p. This report describes the development of the Princeton University Three-Dimensional Analog Computing Facility and the modification of the Princeton University Two-Dimensional Analog Tank so that it could yield solutions to Prandtl's lifting line equation. The theory necessary for the operation of the two facilities is given. The methods of construction of the tanks, models and circuits are presented. 6 refs.

137 **Special purpose analogue computer.** Industrial Nucleonics Corp., *B.P. 853139,* 2 Nov. 1960. An analogue computer for determining statistical variance comprises circuitry for evaluating a specified equation.

138 **Analogue computer.** Compagnie Generale de Telgraphic sans Fil and Soc. Marocaine de Recherches, d'Etudes et de Developpement, *B.P. 853201,* 2 Nov. 1960. This patent discloses an analogue computing system for computing a function y of at least one variable, given by $y=F(X)$ within a predetermined interval of values of at least one of these variables given by X, only discrete values of y being known. The system performs the weighted summation $A_1f_1(X)+A_2f_2(X)\ldots A_Nf_N(X)=y$ where $f_1(X)\ldots f_N(X)$ are predetermined functions of X independent of $F(X)$, and $A_1\ldots A_N$ are parameters chosen in view of performing the weighted summation.

See also :—
Techniques, Ref. 67.

DIGITAL

139 **Apparate und Anlagen.** (Apparatus and equipment.) *Elektronische Rechenanlagen,* **2,** Nov. 1960, 208-211. Illustrated descriptions of the following :

a. **Datenverarbeitungssystem ICT 1301.** (Data Processing System ICT 1301). p. 208. (In German.)

b. **Input and output equipment for the RCA 501.** p. 209-211. (In English.) Continued from *ibid.* **2,** May 1960, 94-98 (*C.A.,* **4,** July 1960, Ref. 1268*b*).

140 **A chart for EDP experts.** C. W. Adams, *Datamation,* **6,** Nov./Dec. 1960, 13-17. The important characteristics of 43 digital computers are presented in tabular form, the intention being to provide a pocket-size chart to assist consultants in answering clients' questions. The computers covered by the chart are as follows: Autonetics Recomp II; Bendix G-20 and G-15; Burroughs 220, 205 and E-103; Control Data 1604 and 160; Digital Equipment PDP-3 and PDP-1; El-Tronics Alwac III-E; General Electric 210 and 225; IBM Stretch (7030), 7090, 7080, 709, 705, 704, 7070, 7074, 650, 1401, 305 and 1620; Honeywell H-800 and H-400; Monroe Monrobot XI; N.C.R. 304; Packard Bell PB 250; Philco 2000; RCA 601, 501 and 301; Remington Rand Univac Larc, 1105, 1103A, II, III, File Computer and SS80/90; and Royal McBee RPC 9000, RPC 4000 and LGP-30.

141 **Digital Computer Newsletter.** G. D. Goldstein (Ed.), *Commun. ACM*, **3,** Oct. 1960, 575-590. Reprint of **12,** Oct. 1960 issue of a restricted circulation, U.S. Office of Naval Research publication. Includes information on the following computers and associated equipment: new read-out system for the Pennsylvania State University PENNSTAC (p. 576); Remington Rand Naval Tactical Data System (p. 576-578); Western Reserve University Relay Searching Selector and GE-225 computer (p. 578); Ferranti Atlas (p. 580-582); Hitachi Co., Ltd. (Japan) computers HIPAC-101, HIPAC-103, HITAC-102, HITAC-301, and HITAC-502 (p. 583-584); LEO III (p. 583, 585); Standard Elektrik Lorenz A.-G. SEL-K10 magnetic tape unit (p. 586); Telefunken TR 4 computer (p. 586-589); National Cash Register Company photochromic projection display; and Stanford Research Institute all-magnetic arithmetic unit. There are also notes on activities at various computer centres.

142 **Small computers.** *Auto. Data Processing*, **2,** Nov. 1960, 29-34, 36, 38. Part II of a survey of data processing equipment (for Part I see *C.A.*, **4,** Nov. 1960, Ref. 2190), giving brief descriptions and specifications of the following small digital computers available in Britain; E.101 (Burroughs Adding Machine Ltd.); 300 DP, and Gamma 3 (De La Rue Bull Machines Ltd.); ARGUS and Sirius (Ferranti Ltd.); 609, 1401, 610, and 1620 (IBM United Kingdom Ltd.); PCC, 555, and 1202 (ICT Ltd.); 802 and 803 (National-Elliott); LGP-30 and RPC-4000 (Royal McBee); and Zebra (Standard Telephones & Cables Ltd.).

143 **Human factors affecting console design in the FIELDATA system.** C. F. Hoban, R. O. Lucier and R. Flood, University of Pennsylvania, *PB 149392*, 31 July 1959, 41 p. The role of human factors in system development in general, with particular reference to their treatment in the U.S. Army FIELDATA system, is studied. The consoles of the computer family being designed for the Signal Corps are then analysed in detail as man/machine interface. A critical examination is given of the parallel, rather than sequential development plan that has been adopted in the FIELDATA system. Some of the problems analysed include invariances in logic and console topography of different computers, and the complexities of a multifunctional console. Among the specific recommendations for improved console design are arabic numeral keyboards, redundant state indicators and mechanical guards. 1 ref.

144 **Digital computer.** Metropolitan-Vickers Electrical Co., Ltd., *B.P. 851418*, 19 Oct. 1960. This patent describes a digital computer having a fast access working store operating in parallel mode and a slower access working store which operates in series mode; it also has a buffer store which operates in parallel mode. Transfer between the buffer store and the two working stores takes place at the respective operating rates of those two stores.

145 **Digital computer.** Soc. d'Electronique et d'Automatisme, *B.P. 853695*, 9 Nov. 1960. A digital computer is provided with improved arrangements for the transfer of instructions from a small capacity, fast access intermediate memory to a one-instruction memory in the control unit.

146 **Binary computer.** N. V. Philips' Gloeilampenfabriek, *G.P. 1090885*, 13 Oct. 1960. This patent describes a binary digital computer operating in the parallel mode and which is capable of performing automatically the calculation $x+yz$.

See also :—
Techniques, Ref. 67.

PROGRAMMING

147 **A common language to program computers for business problems—second report.** C. A. Phillips, *Computers & Automn.*, **9,** Oct. 1960, 6-8. An account of progress with the development of COBOL and other tasks undertaken by the Conference on Data Systems Languages (CODASYL).

148 **An explanation of ALGOL 60.** I. Flores, *Datamation*, **6,** Sept./Oct. and Nov./Dec. 1960, 46-50; 65-66, 68, 70, 76. This paper discusses the concepts which must be provided for in a problem language, and specifically in ALGOL 60.

149 **A list of computer systems programs for the IBM 650, DATARON 205, and UNIVAC SS-80.** *Commun. ACM*, **3,** Oct. 1960, 537-538. List of systems programs which includes work done over the past four years by Shell employees. Most of the work is available for distribution upon request. The programs are grouped under the following headings: Operating Systems (3); Assemblers (6); Interpreters (7); Simulators (2); Compilers (2); Translators (1); and Plotting Routines (2).

150 **Logic—and the principles of programming.** A. M. Hilton, *Electrical Mfg.*, **66,** July 1960, 71-77. Basic principles of programming techniques based on logical reasoning expressed by Boolean algebra and the propositional calculus are explained, and automatic coding systems are introduced. 25 refs.

151 **Recursive programming.** E. W. Dijkstra, *Numerische Mathematik*, **2,** 12 Oct. 1960, 312-318. This paper presents a programming method, called recursive programming, free of two disadvantages which arise if every subroutine has its own private working space. One disadvantage is that the storage allocations for all the subroutines together will, in general, occupy much more memory space than they ever need simultaneously. The other and more serious disadvantage is that it is impossible to call in a subroutine while one or more previous activations of the same subroutine have not yet come to an end, without losing the possibility of finishing them off properly later on. The principles are described of a program structure with which these disadvantages do not arise. The basic concept of recursive programming is the so-called stack which is used for storing a sequence of information units that increases and decreases at one end only, i.e. when a unit of information that is no longer of interest is removed from the stack, then this is always the most recently added unit still present in the stack.

152 **Common programming language task. Part II. Automatic code translation system (ACT).** A. W. Holt, W. J. Turanski and D. L. Meginnity, University of Pennsylvania, *PB 149394*, 31 July 1959, 143 p. The report is divided into four portions, the first three of which are directly concerned with the ACT system, while the fourth (Appendix) is an example of a specialised code—Symbolic Logistico-Administrative Code (SLAC). The sections are concerned, respectively, with a general description of the Automatic Code Translation System (general purpose allocation interpreter and "core library", etc.), a description of the allocation interpreter, and a discussion of Canonical Form. The SLAC system (Appendix) has a direct relation with the section on Canonical Form.

153 **Some applications of logical syntax to digital computer programming.** R. M. Carp, Harvard University, *PB 147350*, Jan. 1959, 200 p. In this thesis the methods of logical syntax are applied to the analysis of programming languages. The programming languages considered include not only computer languages, but also flowcharting languages and the source languages of automatic programming systems. Syntactic models are defined and used for the development of analytic check-out procedures and techniques for improving the efficiency of programs. 54 refs.

See also :—
General, Ref. 2; **Techniques,** Ref. 70.

APPLICATIONS

AERONAUTICAL

154 **Digital control techniques for space.** L. F. Jones and P. Margolin, *1960 IRE Wescon Convn. Record*, Part 4, 6-23. In this paper the considerations affecting the use of digital computer controllers in space vehicles (manned or unmanned) are explored in the light of expanding space programmes in the U.S.A. The projected augmentation of system control capability is contrasted with the penalties (of size, weight and power) incurred, to determine under what conditions a digital computer controller can be employed to advantage. System control functions are analysed to determine the corresponding digital computer requirements. Digital computer hardware techniques are surveyed in terms of size, weight and power both as regards electronic circuit techniques and packaging. It is concluded that it would be desirable and feasible to include in a digital computer controller, a combination of a magnetic disc memory, transistor-diode circuitry, code disc input devices, permanent magnet stepping motor output devices, flexible multiple layer printed circuitry and molecular electronic blocks. 20 refs.

155 **Quelques remarques sur l'intégration du mouvement autour du centre de gravité dans un simulateur.** (Observations on the integration of motions about a centre of gravity with a simulator.) F. H. Raymond, *Ann. Assn. Int. Calcul Analogique*, **2,** Oct. 1960, 181-189. (In French.) This paper concerns the general conception of a flight simulator which is based on the analogue solution of the equations which describe the flight of a body. After presenting the equations of motion of the centre of gravity and of movement about this centre, different procedures are discussed which enable certain singularities to be avoided in the simulation when transformations of kinematic coordinates are effected. The principles of a general solution of the problem which avoids all singularities are established. Finally, a method of calculation for the transformations is described.

156 **Numerical solutions of shock-induced unsteady boundary layers.** S. H. Lam, Princeton University, *PB 147265*, August 1959, 41 p. Numerical solutions for the shear function $\phi(\alpha,\beta)$ and the Reynolds analogy coefficient Ra are presented. The calculations were performed on the Wright Field Univac Scientific 1103 using the Wright Field "CHIP" interpretive system. 1 ref.

157 **Programming of digital computers for determination of stability and control characteristics. Volumes I and II.** D. E. Drake, E. R. Keown and J. R. Matlock, Douglas Aircraft Co., Inc., *PB 161924*, 1 July 1959, 596 p. The analysis of the stability and control characteristics of a flight vehicle configuration is a long, complicated problem. The compilation of the USAF Stability and Control Handbook (M-03671) represents a major contribution to the solution of this problem. The purpose of the research reported is to simplify the necessary computations by replacing the nomograms of the Handbook with numerical tables and procedures and to place the resulting calculation on a large scale digital computer. It was found that the graphical techniques of the Handbook lent themselves readily to numerical analysis and no special difficulties were encountered in programming the procedures. See also Refs. 158 and 159.

158 **Programming of digital computers for determination of stability and control characteristics. Volume III, Appendix II.** D. E. Drake, E. R. Keown and J. R. Matlock, Douglas Aircraft Co., Inc., *PB 161925*, 1 July 1959, 417 p. See Ref. 157.

159 **Programming of digital computers for determination of stability and control characteristics. Volume IV and V, Appendix III.** D. E. Drake, E. R. Keown and J. R. Matlock, Douglas Aircraft Co., Inc., *PB 161926*, 1 July 1959, 312 p. See Ref. 157.

160 **Satellite launching trajectory calculations: a multistage, two-dimensional, zero-lift program for NAREC.** J. L. Hammersmith, Naval Research Lab., Washington, *PB 147834*, 20 June 1960, 6 p. Because all programs were done in basic NAREC coding, which allows only fixed point arithmetic, the formulas for apogee calculations were rescaled to permit greater distances and higher velocities. The procedure used to select suitable trajectories in some of the programs frequently collapsed when they were used for vehicles radically different from Vanguard. The program described in this report was constructed with many features which render it more efficient in such cases.

See also :—
Miscellaneous, Ref. 200*a*.

BUSINESS

161 **Epidemic at the chemists.** *Auto. Data Processing*, **2,** Nov. 1960, 20-22. Brief, general account of the merchandise accounting system being implemented with an Emidec 1100 by Boots Pure Drug Co., Ltd., to control the stocks of some 60,000 lines supplied to their branches.

162 **Lochkarten und Datenverarbeitung bei einer schweizerischen Grossbank.** (Punched cards and data processing in a big Swiss bank.) E. Burgermeister, *Elektronische Rechenanlagen*, **2,** Nov. 1960, 194-201. (In German.) English abstract: "The article endeavours to show the important technical changes effected in the office work of Swiss banks as a result of the introduction of modern labour-saving methods. The principal aims are greater efficiency in service to clients and an increased work potential by the installation of punched card systems and data processing equipment. The author quotes examples of the interaction of bank practice and technique drawn from his own practical experience in the operations department of the Swiss Credit Bank. The problems involved had to be treated as a whole: the individual approach to the client had to be maintained, and it was important to include the smaller branches of the Bank in the scheme in order to obtain both a uniform procedure and the maximum advantage from the new installations."

163 **A note on the calculations of interest.** P. Z. Ingerman, *Commun. ACM*, **3,** Oct. 1960, 542-543. This note deals with a method of determining the periodic payment necessary to retire a loan when the interest rate on the loan varies (possibly from period to period) as a function of the as-yet-unpaid principal. A description of the process is given in ALGOL.

164 **What business needs most from manufacturers of electronic data processors.** B. Conway, *Computers & Automn.*, **9,** Nov. 1960, 6-8. After considering the needs of business users as related to present equipment, requirements which may arise in the near future are discussed. It is suggested that there are three basic future requirements: cheaper equipment, especially for medium and small scale systems; very large random access storage systems; and the development of the systems package encompassing both the systems and the machine.

See also :—
Programming, Ref. 147.
Control—Production and Process, Refs. 173, 174, 175.
Miscellaneous, Refs. 200*e*, 200*f*, 200*i*.

CHEMICAL

165 **Closed-loop computer control at Luling.** R. D. Eisenhardt and T. J. Williams, *Control Engng.*, **7,** Nov. 1960, 103-114. Account of the control system employing a Thompson-Ramo-Wooldridge RW-300, which is successfully operating at the Monsanto Chemical Company's ammonia plant at Luling, Louisiana, U.S.A. After briefly indicating how the installation of computer control was economically justified, a description is given of the process by which ammonia is produced at the plant. The development of the mathematical model from plant data is explained, and the necessary revisions in plant instrumentation are described. Installation of the computer, testing of the programs and putting the computer on line for closed loop control is then outlined. Finally, the gains from comuter control, future developments and the training of the computer systems team are discussed.

166 **Computer control of chemical process in practical use.** *Automn. & Auto. Equipment News*, **6,** Nov. 1960, 139-140. Abbreviated excerpt from two papers by J. M. Madigan giving brief details of the use by the B. F. Goodrich Chemical Company of an RW-300 for controlling a new vinyl chloride process and the production of acrylo-nitrile.

See also :—
Miscellaneous, Ref. 200*j*.

CONTROL—GENERAL SYSTEMS

167 **Digital speed-control analysis by analog-computer methods.** D. W. Leiby, *Electrical Mfg.*, **65,** May 1960, 178-186. Describes a numerical speed control system (for an electric motor), combining analogue and digital computer methods, and the investigation by means of analogue simulation techniques of its transient performance for changes in reference speed and operating load. Results showing the effects of sampled-data and quantised-data operation upon the performance of such systems are discussed. 7 refs.

168 **Optimizing linear dynamics for human-operated systems by minimizing the mean square tracking error.** T. E. Leonard, *1960 IRE Wescon Convn. Record*, Part 4, 57-62. This paper describes a study concerned with compensatory tracking tasks where a human is a part of the closed loop tracking system. A minimum mean square tracking error criterion is adopted to establish linear control system dynamics that are best suited for human control. An IBM 650 was used to calculate the mean square tracking error for a representative statistical input as a function of conceivable compensation dynamics and amplification. The computations used the statistical scheme of integrating the product of the error transfer function and the input frequency power spectrum. The computer output is examined for minimum mean square error trends as parameters are varied. From a comparison of the computed results with experiment it is concluded that the trained human often adopts dynamics that nearly minimize the mean square tracking error. 3 refs.

169 **Recent advantages in the field of sampled data and digital control system.** E. I. Jury, University of California, *PB 146738*, 20 Oct. 1959, 39 p. Theoretical aspects are described of the progress made in the field of sampled data and digital control systems during the last few years. The major topics considered are linear theory, statistical theory, non-linear theory and time-varying theory. These topics are briefly described and methods of analysis and design with their major purposes and achievements are enumerated. A brief survey of digital control systems is discussed and it is indicated how the above topics can be extended to these systems. 49 refs.

170 **Automatic control system employing a computer.** Nat. Research Development Corp., *B.P. 852639 & 852640*, 26 Oct. 1960. *B.P. 852639* describes an automatic control system in which one or more controlling means are operated in a random manner, but such operation is over-ridden by a conditional probability computer which receives indications of the states of the controlled element and the controlling means. The system is instructed by simulating at the computer an indication of a desired consequence so that the system "learns" the different consequences of control and will subsequently adopt a desired operation when so instructed. *B.P. 853640* concerns a voltage generating and comparison circuit for the computer.

See also :—
Aeronautical, Ref. 154.

CONTROL—PRODUCTION AND PROCESS

171 **Analog computer for process control.** *Auto. Control,* **13,** Nov. 1960, 27-28. Description of an analogue computer, the C4A/2, introduced by the Swartwout Division of Crane Co., for use with its Autronic instrumentation systems. The computer can extract the square root of a single input or ratio or multiply two inputs from an Autronic primary transmitter.

172 **Computers for process automation.** P. F. Sutherby, *Control,* **3,** Nov. 1960, 93-95. General discussion, with some examples, of the use of analogue and digital computers for process control.

173 **Fertigungsplanung und Fertigungsuberwachung.** (Production planning and control.) E. M. Weide, *Elektronische Rechenanlagen,* **2,** Nov. 1960, 201-207. (In German.) English abstract: "The first part of the paper deals with a theoretical consideration which, starting from the definition of the term "production" attempts to abstract from individual applications and emphasizes features common to all companies. Depending on the practical situation encountered, the electronic installation and the concept of organisation, different levels of practical production planning and control can be achieved. When preparing and developing the programs, special attention should be given to an analysis of the production elements as to the engineering and economic point of view, before developing from these the handling rules and the arrangement of the data. In the following synthesis, the outline of the working process must be defined by stating the task of each program, thus providing a detailed scheme of the logical sequence from the planning to the coding level. . . . In the second part of the paper a practical application is described." The practical application is the use of an ICT 1202 by International Computers and Tabulators Limited at their factory.

174 **Die maschinelle Fertigungsdisposition. Teil 1: Die maschinelle Fertigungsdisposition im Rahmen einer integrierten Datenverarbeitung.** (Production planning and control by computer. Part 1: Production planning and control as a part of an integrated data processing system.) H. Janisch, *Elektronische Rechenanlagen,* **2,** Nov. 1960, 168-171. (In German.) English abstract: "Production planning and control is the basis of an integrated data processing system. In many cases input data or interim results can be used jointly for different tasks. This integration leads to an essential time and cost reduction in data processing." See also Ref. 175.

175 **Die maschinelle Fertigungsdisposition. Teil 2: Das Dispositionssystem.** (Production planning and control by computer. Part 2: The planning system.) H. Arnold, *Elektronische Rechenanlagen,* **2,** Nov. 1960, 171-176. (In German.) English abstract: "Basic concept and decision data of a universal system for production planning and control, specially suited for computer application, are discussed. Planning data are integrated by means of a three-dimensional calculus: quantities, deadline dates and construction levels. Quantities to be ordered or manufactured are computed by comparison procedures from original customer demand, broken down to quantities per deadline date. By breakdown of these quantities into the next lower construction level, secondary demand is calculated. This procedure is repeated for all construction levels within the factory, as defined by parts list or production step interrelations. Thus secondary demand for all intermediate manufactured items as well as raw materials and resulting purchase or manufacturing orders in terms of quantities per deadline date is computed from customer demand for finished products. By adding or suppressing certain factors within the basic formula all practicable types of production planning and control systems can be construed as variations of a universal concept and served by a single computer program." See also Ref. 174.

See also :—
Chemical, Refs. 165, 166.
Miscellaneous, Refs. 200*h*, 200*i*.

ELECTRONICS

176 **Mathematical circuit analysis and design.** Remington Rand Univac Division, *PB 148222,* 29 Feb. 1960, 40 p. This report describes an attempt to develop a mechanised routine for the design and fault diagnosis of electronic circuits, summarises the progress to date and suggests areas for future study. A method has been devised for translating any schematic diagram into computer language so that each component and its location is specifically described. A method has been established and programmed for Univac to generate the complete set of irredundant nodal and branch equations which will handle both linear and non-linear characteristics of the circuit parameters. Finally, the set of equations has been reduced by eliminating all variables not required for the solution of the component parameters. A sample circuit is given; a copy computer printout accompanies the description of each stage of the analysis.

ENGINEERING, ELECTRICAL

177 **Power-supply circuit design by digital-computer method.** H. J. Joyal, *Electrical Mfg.,* **65,** May 1960, 171-177. Describes in some detail the analysis and design of power supply circuits, for solid-state equipment for example, with an IBM 704. 5 refs.

178 **Solving power system problems by means of the a-c-network analyzer with current sources.** V. Vuckovic, P. Miljanic and I. Obradovic, *Ann. Assn. Int. Calcul Analogique,* **2,** Oct. 1960, 190-197. This paper is concerned with the use of an alternating analogue analyser for the study of power changes in an electrical transmission network. It is shown that representing the sources and loads with current sources, instead of the usual voltage generators, in phase and quadrature, leads not only to simplifications in the technique but to a simpler and less expensive analyzer and to a saving of time. The generators and loads are represented by precision current transformers with three windings. 7 refs.

See also :—
Control—General Systems, Ref. 167.

INFORMATION RETRIEVAL

179 **Machine literature searching in science.** A. Kent, *J. Franklin Inst.,* **270,** July 1960, 42-50. Present practices for keeping abreast of literature in any particular field are considered. It is suggested that there should be coordination on a national scale of processing methods and coverage so that a new "library" of encoded information can be used for searching duplication and distribution anywhere by machine methods. Technical, administrative, cooperative and political problems in implementing such a scheme are discussed. 8 refs.

180 **Metallurgical documentation from research to practice.** M. R. Hyslop, *J. Franklin Inst.,* **270,** July 1960, 27-33. General account of the American Society for Metals Documentation Service which employs machine literature searching as developed by Western Reserve University.

181 **Semi-automatic indexing and encoding.** J. Frome, *J. Franklin Inst.,* **270,** July 1960, 3-26. This paper relates to a method of indexing and encoding chemical patents using an IBM RAMAC 305, developed at the U.S. Patent Office. The paper consists mainly of flow charts and examples. 14 refs.

182 **Storing numerical values in an inverted file for mechanized information retrieval.** D. D. Andrews, *J. Franklin Inst.,* **270,** July 1960, 34-41. Account of how the U.S. Patent Office solved a particular problem arising in the development of an information retrieval system for chemical patent searching using an IBM RAMAC 305. The particular problem is concerned with the identification of polymer products by means of "numerical values" such as the temperature and other factors of the process and the melting point and other properties of the product. A description is given of the storage of such numerical values in an inverted file.

See also :—
Learning and Pattern Recognition, Ref. 39.

NUCLEAR

183 **Simplified nuclear reactor simulation.** T. I. Canning, *Automn. Progress,* **5,** Dec. 1960, 406-408. It is suggested that it is unwise to attempt to simulate on an analogue computer every aspect of a particular engineering problem, and that it is better to eliminate all non-essentials by the method of reasonable approximation. In this article simplifications relevant to nuclear reactor simulation are discussed, and the following topics are dealt with: reactor kinetic equations; heat transfer simulation; simulation of heat transfer coefficient; and time lag simulation. A general simplification of equations is also discussed. 8 refs.

184 **Analog computer study of metal-water reactions initiated by nuclear reactor transients.** R. C. Liimatainen et al., Argonne National Lab., *ANL-6129,* May 1960, 195 p.

185 **A general least-squares program for the IBM 650 computer.** L. K. Goodwin, University of California, *UCRL-9263,* June 1960, 22 p.

186 **General reactor analysis computer program for the IBM 704, program George.** T. A. Hoffman and W. B. Henderson, General Electric Co., *APEX-543,* Oct. 1959. 361 p.

187 **STDY-3, a program for the thermal analysis of a pressurized water nuclear reactor during steady state operation.** R. S. Pyle, Westinghouse Electric Corp., *WAPD-TM-213,* June 1960, 42 p.

188 **UFO: A three-dimensional neutron diffusion code for the IBM 704.** E. H. Auerbach, J. P. Jewett and M. A. Ketchum, General Electric Co., *KAPL-1999,* March 1959. 59 p.

PHYSICS

189 **The configurations $3d^n4p$ in the second spectra of the iron group.** G. Racah and N. Spector, *Bull. Res. Council Israel,* **9F,** Nov. 1960, 75-92. The experimental terms of the $3d^n4p$ configurations of the second spectra of the iron group are compared with the results of theoretical calculations. Interpolation formulas are given for the interaction parameters. The numerical calculations were carried out on the Weizmann Institute of Science computer WEIZAC using programs described in "Use of the WEIZAC in theoretical spectroscopy", G. Racah, *ibid,* **8F,** Sept. 1959, 1-14 (*C.A.,* **4,** April/May 1960, Ref. 749). 9 refs.

SIMULATION

190 **The digital simulation of neuro-muscular organisms.** R. F. Reiss, *Behavioral Science,* **5,** Oct. 1960, 343-358. After some critical remarks on previous neural simulation studies in general, a description is given of a particular simulation model and general problems connected with neural simulation studies are commented on. It was decided that the soundest course was to begin by studying the simplest types of neuro-muscular mechanisms, such as are found in the invertebrates and the peripheral reflexes of the vertebrates, rather than attempt to simulate the vertebrate central nervous system. A major premise in selecting a neural model was that neurons are fundamentally analogue devices. It was also taken to be essential that the physical interaction of the whole organism with the environment, not merely isolated nerve nets, should be simulated. The processes involved in the simulation are divided into two groups and are carried out by two distinct programs: the Network Simulator and the Interaction Simulator. The Network Simulator is a general purpose program (which has been coded for the IBM 709) that can simulate networks composed of certain elements, namely "Receptor", "Inter-neuron", "Efferent" and "Muscle". It was not found possible to create a flexible, general purpose model of physical interactions between organisms and environments, so that it is necessary to write a special Interaction Simulator for each organism to be studied. Finally, there is described some programming features of the Network Simulator which may be of general interest in relation to simulation studies. 26 refs.

191 **Simulation Council Newsletter.** J. H. McLeod (Ed.), *Instr. & Control Systems,* **33,** Nov. 1960, 1937-1941, 1943, 1945. Consists mainly of summaries of talks, at the Midwestern Simulation Council Meeting of 9 May 1960, on "Applications of a high-speed repetitive operation analog computer" by G. Graber, "Simulation of a pressure control pump and its control circuits" by A. Seleno and S. Sobolak, "The study of missile system kill probability" by W. Vandervelde, "Vector perturbation method for measuring and instrumenting miss distance" by J. R. Rademaker and A. S. Lange, and "Simulation of adaptive systems" by P. Whitaker.

See also :—
Nuclear, Ref. 183.

TRANSPORT

192 **Digital computer program for acceleration performance, wheeled vehicles.** R. Arno, Ordnance Tank-Automotive Command, Center Line, Michigan, *PB 148391,* 9 Feb. 1960, 45 p. A general computer program has been written for the Electrodata 204 Datatron to calculate acceleration performance and related characteristics for wheeled vehicles. Vehicle performance is determined at prescribed time intervals during acceleration from standstill to maximum velocity. Other additional performance data supplied by the program are vehicle speed, distance travelled, time of travel, wheel torque, tractive effort, rolling resistance, drawbar pull and acceleration.

193 **Digital computer program for center of gravity, product of inertia, and moment of inertia computations.** M. Archambault, Ordnance Tank-Automotive Command, Center Line, Michigan, *PB 148392,* 7 March 1960, 56 p. This report concerns a program for determination of centre of gravity, product of inertia and moment of inertia of a complete vehicle or of individual components and major assemblies. Complete information is printed for the individual items considered.

194 **Digital computer program for tracked vehicle mobility computation.** A. Edwards, Ordnance Tank-Automotive Command, Center Line, Michigan, *PB 148393,* 15 Feb. 1960, 19 p. A general computer program has been written for the Electrodata 204 to provide rapid solution of tracked vehicle mobility performance.

195 **Studies and investigations of traffic control systems.** G. W. Bond, K. S. Gale and J. W. Haake, Armour Research Foundation, *PB 147943,* 9 July 1957, 54 p. A new traffic sample was made which reflects more realistically the available forecasts of 1965 air traffic. Graphical simulations were made of various airways. A simulation of air traffic along an airway was programmed on the IBM 650. Rules for use in simulating and/or controlling off-airways traffic were studied. 1 ref.

196 **Studies and investigation of air traffic control systems.** G. W. Bond, K. S. Gale et al., Armour Research Foundation, *PB 147944,* 9 Jan. 1958, 38 p. Results of a systems analysis and simulation study of a postulated 1965 enroute traffic control system in the New York-Washington area are reported: system description; preliminary analysis; traffic sample considerations; assignment of traffic demand; simulation model considerations; graphical simulation; computer simulation.

MISCELLANEOUS

197 **Animal recipes by computer.** L. Tatham, *Auto Data Processing,* **2,** Nov. 1960, 18-19. Brief, general account of how Crosfield and Calthrop Limited, cattle feed manufacturers, use linear programming and an ICT 1202 to evolve recipes which simultaneously conform to nutritional and technical requirements and are the most economical.

198 **The 1960 Decennial U.S. Census and new elements of data processing.** A. R. Eckler, *Computers & Autmn.,* **9,** Oct. 1960, 18, 22, 24. General account of new methods and equipment such as FOSDIC, used in the 1960 census in the U.S.A.

199 **Do it by the numbers—digital shorthand.** R. W. Bemer, *Commun. ACM,* **3,** Oct. 1960, 530-536. This paper is concerned with the use in communications systems of numeric representations of entire words or phrases rather than character-by-character representations. Present communications systems transmit single characters in groups of coded pulses between simple terminal equipments. Since English words form only a sparse set of all possible alphabetic combinations, present methods are inefficient when computer systems are substituted for these terminals. Various methods for numeric representation of entire words and common phrases are explained and ways of combining computers with existing communication lines are discussed. 5 refs.

200 **Some important applications of computers.** *Computers & Automn.,* **9,** Oct. 1960, 9-16. Consists of the following brief accounts of computer applications :—

a. **Navy aircraft maintenance—optimal scheduling.** I. J. Seligsohn, p. 9. An IBM 704 (to be replaced by an IBM 7090) is used for scheduling maintenance of U.S. Navy aircraft with minimum out-of-service time.

b. **Teaching machine simulated by computer.** J. E. Coulson and H. F. Silberman, p. 9-10. A teaching machine developed by System Development Corporation employs a Bendix G-15 as control and basic decision-making element.

c. **Three important applications of computers.** P. A. Walsh, p. 10-11. An IBM RAMAC 305 is used by the U.S. Coast Guard for charting the courses of merchant vessels to facilitate rescue operations; IBM 709's are used in the Project ECHO satellite communications experiment; and an IBM RAMAC 305 was used in Rome for analysing Olympic Games results.

d. **The appetite for instant news—election predictions.** S. E. Wright, p. 11-13. An account of the bases on which predictions of the results of U.S. Presidential and other elections have been made on UNIVAC.

e. **Some applications of computers.** Service Bureau Corporation, p. 13-14. School registration and grade reporting; demand deposit accounting; and analysis of flexibility of piping.

f. **Low cost bookkeeping for small machines.** C. A. Bail, p. 14. A.S.C. Tabulating Corporation uses a Bendix G-15 in accounting applications for the small businessman.

g. **Meteorological measurement—automatic system for observing and data collecting.** J. F. Stephens, p. 14-15. Automatic meteorological data collecting system for the White Sands Missile Range.

h. **A blending system controlled by computer.** J. F. Stephens, p. 15. System employing a Bendix G-15 to demonstrate the feasibility of applying computer control to continuous, multi-channel blending processes.

i. **Animal medicine manufacturing.** F. J. Ritchie, p. 15-16. Use by Anchor Serum Company, manufacturers of animal medicines, of an LGP 30 for production planning, sales analysis, inventory control and other applications.

j. **Oil refinery production and storage.** F. J. Ritchie, p. 16. LGP 30 is used for refinery design problems at J. F. Pritchard and Company.

201 **Forecasting micrometeorogical variables.** G. A. Franceschini, Texas A. and M. College, *PB 149010,* Dec. 1959, 73 p. An objective evaluation was conducted on the utility of a specialised analogue for micrometeorology. Values of parameters simulated by the computer are compared with values observed. 4 refs.

202 **Micrometeorological observations over non-ideal surfaces.** G. A. Franceschini, Texas A. and M. College, *PB 149009,* Dec. 1959, 197 p. The measurements reported were made primarily for the purpose of furnishing a basis for the evaluation of an analogue computer designed to simulate certain micrometeorological parameters in the surface layer of the atmosphere. 1 ref.

203 **Research directed towards the study and application of digital data-processing methods to the problem of sensing and recording meteorological variables at various levels on an existing 1400-foot tower.** W. S. Mitcham and J. R. Gerhardt, University of Texas, *PB 149442,* 30 April 1960, 19 p. This report gives a broad survey of the operating, design and data utilisation features of the meteorological tower system.

BOOKS

204 **Basics of analog computers.** T. D. Truitt and A. E. Rogers, John F. Rider Publisher, Inc., 1960, 400 pages, $12.50. An introduction, suitable for those without previous knowledge of the subject, to analogue computers in which the construction, operation and use of analogue computers and the mathematical concepts involved are explained in simple terms with the aid of some 400 pictorial diagrams. The chapter headings are: Introduction to analogs; Why analog?; Computer building blocks; The mathematics of computing; General purpose analog computer types; D-C analog computer—linear computing components; D-C analogue computer—multiplying components; D-C analog computer—function generation; Monitoring and control; Programming and problems; and Applications.